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INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification 6 : <b>H04H 1/00</b>	A2	(11) International Publication Number: <b>WO 98/25364</b> (43) International Publication Date: 11 June 1998 (11.06.98)
(21) International Application Number: PCT/US97/13572 (22) International Filing Date: 31 July 1997 (31.07.97)  (30) Priority Data: 08/760,640 4 December 1996 (04.12.96) US		(81) Designated States: JP, European patent (AT, BE, CH, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE).  Published <i>Without international search report and to be republished upon receipt of that report.</i>
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(54) Title: MULTI-STATION AUDIO DISTRIBUTION APPARATUS		
(57) Abstract		
<p>A multi-station audio distribution apparatus having at least two listening stations, a data control mechanism and a listening station interface mechanism disposed between the listening stations and the data control mechanism. Each of the listening stations has a user input in the form of a barcode scanner to enter an audio material selection and each has an audio output. The data control mechanism retrieves digitized audio material corresponding to each of the user's audio material selections. The listening station interface mechanism transfers the user's inputs from each of the listening stations to the data control mechanism, receives the digitized audio materials corresponding to each user's input from the data control mechanism, converts the digital audio materials to analog audio signals and transfers the analog audio signals to each of the respective listening stations for the audio output.</p>		

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**MULTI-STATION AUDIO DISTRIBUTION APPARATUS****BACKGROUND OF THE INVENTION**

This invention relates to a sound sampling device and more particularly to a multi-station audio distribution apparatus for sampling audio material.

Few retail music stores allow test sampling of the compact discs and/or cassettes that they sell. Thus, a music consumer is left to rely on the radio stations to first hear what may be contained on a compact disc. Radio stations, however, generally play only one selection from a compact disc that may contain ten or more musical selections. The result is that a musical consumer buys a compact disc based on the one selection they've heard only to be disappointed by the additional selections which are not equivalent in quality or are not to the liking of the consumer. After repeated occurrences of the afore described situation, the disappointed consumer will inevitably meet a level of frustration at which point they will buy only a compact disc containing a single selection, at much lower cost than the album compact disc, or will stop buying compact discs altogether. In either situation, the profits of the retail music store are reduced.

Those retail music stores that do allow test sampling, do so by actually opening a compact disc or cassette and inserting the cassette or disk into the player for the consumer to hear. Generally, the store is limited to one or two players and the retail store will only open those discs which it believes will be popular and will sell. The limitations are thus apparent, a retail music store may be full of customers yet only one or two may listen to a musical sample. Further, those consumers that are interested in non-mainstream music are left in the cold with no opportunity to sample their preferred music.

Based on the foregoing, there is a need for an apparatus that will allow a number of consumers to simultaneously listen to different discs of all types of music and will allow the user to hear more than a sample of one selection contained on the compact disc.

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### SUMMARY OF THE INVENTION

A multi-station audio distribution apparatus having at least two listening stations, a data control mechanism and a listening station interface mechanism disposed between the listening stations and the data control mechanism. Each of the listening stations has a user input in the form of a barcode scanner to enter an audio material selection and each has an audio output. The data control mechanism retrieves digitized audio material corresponding to each of the user's audio material selections. The listening station interface mechanism transfers the user's inputs from each of the listening stations to the data control mechanism, receives the digitized audio materials corresponding to each user's input from the data control mechanism, converts the digital audio materials to analog audio signals and transfers the analog audio signals to each of the respective listening stations for the audio output.

An object and advantage of the present invention is that the multi-station audio distribution apparatus may utilize multiple listening stations that are controlled by a single data control means.

Another object and advantage of the present invention is that barcode scanning may be used to select the desired audio material.

Another object and advantage of the present invention is that random access to audio material is provided at any and all of the listening stations.

Yet another object and advantage of the present invention is that data related to the selected audio material may be displayed at each listening station. As well, apparatus adjustments such as forwarding/reversing to a different track of the audio material, fast forwarding/reversing through a selected audio track and volume control may also be provided at each listening station.

Still another object and advantage of the present invention is that low voltage wiring is used to connect each listening station to the listening station interface means.

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Another object and advantage of the present invention is that the multi-station audio distribution apparatus performs playback of audio material stored in multiple digital formats.

Another object and advantage of the present invention is that the multi-station audio distribution apparatus provides scalable architecture that can grow from a small to a massive apparatus.

#### BRIEF DESCRIPTION OF THE DRAWINGS

Figure 1 depicts components of one listening station, one listening station interface means and the data control means of the present invention; and

Figure 2 depicts the layout of the present invention with its single data control means and multiple listening stations and listening station interface means.

#### DETAILED SPECIFICATION

The multi-station audio distribution apparatus 10 generally comprises three component parts, a listening station 20, a listening station interface means 40 and a data control means 60.

The layout of the listening station 20 is shown in Figure 1. The listening station 20 at a basic level incorporates a user input in the form of a barcode scanner 22, an audio output 24, which may be a speaker and/or a standard stereo phono jack attached to headphones, and a software controlled microcontroller 26. The barcode scanner 22 and audio output 24 are tied to the microcontroller 26 which handles the transfer of all inputs into the listening station 20 and all outputs out of the listening station 20. The listening station 20 may further incorporate a keypad 28 and a visual display 30 such as a liquid crystal display. The keypad 28 can be used to input apparatus adjustments such as volume control, audio track selection and speed of playback. Further, the keypad 28 may be enabled for other input functions such as "help", "price", "additional information", "similar music", and "interview with artist or author". The visual display 30 can be used

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to display informational data relating to selected audio material such as the title of a track, name of the artist or author, price, label, genre, media, etc. As with the barcode scanner 22 and audio output 24, the keypad 28 and visual display 30 are tied to the software controlled microcontroller 26 to handle inputs to and outputs from the listening station 20.

The listening station interface means 40 is also shown in Figure 1. Depending on hardware configuration the listening station interface means 40 may be adapted to accommodate one or two listening stations 20. Each listening station interface means 40 is generally in the form of a circuit board powered by low voltage direct current. Contained within the circuit board is a microcontroller 42 under program control having random access memory and read only memory, a digital interface 44, an analog interface 45, a digital to analog converter 46 and a data control means interface 48. The digital interface 44 is tied to the microcontroller 42 and is connected to the listening station 20 via a low voltage digital interface cable 50. The digital to analog converter 46 is also tied to the microcontroller 42 and is connected to the listening station 20 through the analog interface 45 via a low voltage analog interface cable 52. The microcontroller 42 is connected to the data control means 60 via the data control means interface 48. The microcontroller 42 serves as the data and audio signal transfer mechanism between the data control means 60 and the listening station 20.

The data control means 60, see Figure 1, comprises a standard computer platform that incorporates a power supply, a backplane/bus 61 that is connectable to the data control means interface 48 of the listening station interface means 40, a microprocessor 63, random access memory, and interfaces to various peripherals such as disk drives that operate in conjunction with disk controllers, modems, video displays, keyboards, and tape backup units. The data control means 60, or computer platform, utilizes operating system software 62 (e.g. UNIX) that has low level device drivers 64, file management utilities 66 and further utilizes application software 68 that operates within the computer platform to implement the full functionality of the apparatus 10. The computer platform also incorporates high-speed random access storage of audio material in digital form; the audio material is contained in data files stored on internal or external hard drives 70 that are

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connected to interfaces within the computer platform. The data control means 60 is connected to the listening station interface means 40 via the data control means interface 48 which is a computer bus.

The layout of the multi-station audio distribution apparatus 10 is shown in Figure 2, its operation as applied to a retail music store is preferably described as follows. A user selects a music CD (compact disc) 72 from among those offered for sale. The user takes the CD 72 to a nearby listening station 20 puts on the attached headphones and passes the barcode 74 that is imprinted on the CD label under the barcode scanner 22.

The barcode scanner 22 transmits the barcode 74 through a serial data connection to the software controlled microcontroller 26 contained within the listening station 20. This data is received by the microcontroller 26 and temporarily stored in RAM under program control. The program packetizes the data and re-transmits it to the listening station interface means 40 through the digital interface cable 50, which is a 6-conductor modular cable. The data packet is received, after passing through the digital interface 44, as a serial bit stream by the listening station interface means' microcontroller 42 and temporarily stored in RAM under the microcontroller's (42) program control.

The microcontroller (42) program waits for a request from a device driver 64 within the data control means 60 before sending the barcode data back through the data control means bus interface 48 to the data control means 60. The device driver 64 polls each listening station interface means 40 approximately every 500 microseconds to exchange data, using an I/O (input/output) address within the data control means 60. The device driver 64 passes the barcode data to the application software 68 running on the data control means 60. The application software 68 then performs a database search against an index of all such barcodes contained within the data control means 60. This database and its index are created before the application software 68 is executed.

Assuming a match is found in the index, the corresponding database record is retrieved from a master file on the hard drive 70. This record contains informational data items relating to the CD 72 selected by the customer, such as artist, title, label, genre,

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media, barcode, price and filename. These informational data items are transmitted back to the listening station 20 through the chain described above (i.e. from the data control means 60 to the listening station interface means 40 via the data control means interface 48, then to the listening station 20 via the digital interface 44 and the digital interface cable 50). The informational data items can be displayed on the visual display for review by the user.

The filename retrieved from the database record is then used by the data control means 60 to access the audio material stored in digital form as a file on the hard drive 70. This function is performed by the operating system software 62 under the direction of the application software 68. Blocks of data are read from the hard drive 70, passed through a disk controller and temporarily buffered in RAM (random access memory). The application software 68 processes a "header" portion of the file which consists of approximately one kilobyte of data; the bytes of data include duplicates of fields contained in the master database as well as the compression method used to encode the audio material. The application software 68 then strips the header from the file and instructs the device driver 64 to send the remainder of the file to the listening station interface means 40, one "word" (i.e. 16 bits) at a time. This file of audio material can be mono or stereo and can be encoded as linear, uLaw, ADPCM or other algorithms at various digitization rates.

The microcontroller 42 within the listening station interface means 40 stores each word of the audio material in a FIFO (first in, first out) buffer, reporting the buffer status (full, half-empty, empty) back to the device driver 64 as needed to retrieve further audio material. The program directing operation of the microcontroller 42 empties the buffer by sending bytes of the audio material to the Digital-to-Analog converter 46, which translates the encoded bytes into an analog stereo signal. This analog stereo signal is amplified within the listening station interface means 40 before being sent to the listening station 20 through the analog interface 45 and the analog interface cable 52, which is a 8-conductor modular cable that is separate and distinct from the digital interface cable 50 described previously. The amplitude of the analog stereo signal is controlled by the listening station interface means' circuitry. The analog stereo signal received by the listening station 20 is

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passed directly to the audio output 24 which may be a speaker or a phono jack attached to headphones. The user hears the analog stereo signal from the selected CD 72 approximately a second or two after scanning the barcode 74.

A sample of three or more tracks from the CD 72 are typically stored on hard drive(s) in digital form. The visual display 30 may show the track number that is currently playing, as determined by the application software 68. The user may push a button on the keypad 28 at the listening station 20 to hear the next track or a previous track from the same CD 72. In addition, the user may press a "volume up" or "volume down" button on the keypad 28 to adjust the volume of the analog stereo signal. These keypad 28 depressions are read by the software controlled microcontroller 26 within the listening station 20 and are passed to the listening station interface means 40, to the device driver 64 and to the application software 68 for interpretation, action and responsive outputs consistent with apparatus adjustment keypad inputs. Other keypad buttons can be enabled for functions such as "help", "price", "additional information", "similar music", "interview with artist".

The customer merely has to scan another CD 72 to start the process over again. With the potential for many listening stations 20 in a single store location, the apparatus 10 depends on very high-speed processors and data storage.

While the above describes a retail music store application, the same might be applied to a book store or even a library to sample books on CD or tape.

The present invention may be embodied in other specific forms without departing from the spirit of the essential attributes thereof; therefore, the illustrated embodiment should be considered in all respects as illustrative and not restrictive, reference being made to the appended claims rather than to the foregoing description to indicate the scope of the invention.

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**IN THE CLAIMS:**

1. A multi-station audio distribution apparatus that allows a plurality of users to simultaneously sample different audio tracks, comprising:
  - (a) at least two listening stations, said at least two listening stations each having a user input and an audio output such that an analog audio signal corresponding to said user input may be heard;
  - (b) data control means, said data control means for retrieving digitized audio material corresponding to each of said user inputs; and
  - (c) listening station interface means, said listening station interface means disposed between said data control means and said at least two listening stations, said listening station interface means for transferring each of said user inputs from its respective listening station to said data control means, for receiving each of said digitized audio materials corresponding to each of said user inputs, for converting each of said digitized audio materials to said analog audio signals and for transferring each of said analog audio signals to its respective listening station.
2. The multi-station audio distribution apparatus of claim 1, comprising more than two of said listening stations.
3. The multi-station audio distribution apparatus of claim 1, comprising a plurality of listening station interface means.
4. The multi-station audio distribution apparatus of claim 1, wherein said at least two listening stations each further comprises a visual display to display informational data corresponding to said user inputs and a keypad to enter apparatus adjustments.
5. The multi-station audio distribution apparatus of claim 4, wherein said apparatus adjustments comprise a volume control and track select.

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6. The multi-station audio distribution apparatus of claim 4, wherein said data control means is further used for retrieving said informational data corresponding to each of said user inputs and for producing responsive outputs consistent with each of said apparatus adjustments and wherein said listening station interface means is further used for transferring said informational data from said data control means to its respective listening station, for transferring said apparatus adjustments from their respective listening station to said data control means and for transferring said responsive outputs from said data control means to their respective listening station.

7. The multi-station audio distribution apparatus of claim 1, wherein said data control means is a computer.

8. The multi-station audio distribution apparatus of claim 1, wherein said audio output comprises a phono jack connectable to headphones.

9. The multi-station audio distribution apparatus of claim 1, wherein said listening station interface means is powered by low voltage direct current and wherein said listening station interface means is connected to said at least two listening stations by low voltage cables.

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10. A multi-station audio distribution apparatus that allows a plurality of users to simultaneously sample different audio tracks, comprising:

- (a) at least two listening stations, said at least two listening stations each having a barcode scanner to produce a barcode reading, a visual display to display informational data corresponding to said barcode reading, and an audio output such that an analog audio signal corresponding to said barcode reading may be heard;
- (b) data control means, said data control means for retrieving said informational data corresponding to each of said barcode readings and for retrieving digitized audio material corresponding to each of said barcode readings; and
- (c) listening station interface means, said listening station interface means disposed between said data control means and said at least two listening stations, said listening station interface means for transferring each of said barcode readings from its respective listening station to said data control means, for transferring said informational data corresponding to each of said barcode readings from said data control means to its respective listening station, for receiving each of said digitized audio materials corresponding to each of said barcode readings, for converting each of said digitized audio materials to said analog audio signals, and for transferring each of said analog audio signals to its respective listening station.

11. The multi-station audio distribution apparatus of claim 10, comprising more than two listening stations.

12. The multi-station audio distribution apparatus of claim 10, comprising a plurality of listening station interface means.

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13. The multi-station audio distribution apparatus of claim 10, wherein said at least two listening stations each further comprises a keypad to enter apparatus adjustments, wherein said data control means is further used for producing responsive outputs consistent with each of said apparatus adjustments, and wherein said data control means is further used for transferring each of said apparatus adjustments from each of said listening stations to said data control means, for transferring said responsive outputs consistent with each of said apparatus adjustments from said data control means to its respective listening station.

14. The multi-station audio distribution apparatus of claim 13, wherein said apparatus adjustments comprise a volume control and a track select.

15. The multi-station audio distribution apparatus of claim 10, wherein said data control means is a computer.

16. The multi-station audio distribution apparatus of claim 10, wherein said audio output comprises a phono jack connectable to headphones.

17. The multi-station audio distribution apparatus of claim 10, wherein said listening station interface means is powered by low voltage direct current and wherein said listening station interface means is connected to said at least two listening stations by low voltage cables.

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18. A multi-station audio distribution apparatus that allows a plurality of users to simultaneously sample different audio tracks, comprising:

- (a) at least two listening stations, said at least two listening stations each having a barcode scanner to produce a barcode reading, a visual display to display informational data corresponding to said barcode reading, an audio output such that an analog audio signal corresponding to said barcode reading may be heard and a keypad to enter apparatus adjustments;
- (b) data control means, said data control means for retrieving said informational data corresponding to each of said barcode readings, for retrieving digitized audio material corresponding to each of said barcode readings, and for producing responsive outputs consistent with each of said apparatus adjustments; and
- (c) a low voltage listening station interface means, said low voltage listening station interface means disposed between said data control means and said at least two listening stations, said low voltage listening station interface means for transferring each of said barcode readings from its respective listening station to said data control means, for transferring said informational data corresponding to each of said barcode readings from said data control means to its respective listening station, for transferring each of said apparatus adjustments from each of said listening stations to said data control means, for transferring said responsive outputs consistent with each of said apparatus adjustments from said data control means to its respective listening station, for receiving each of said digitized audio material corresponding to each of said barcode readings, for converting each of said digitized audio material to said analog audio signals, and for transferring each of said analog audio signals to its respective listening station.

19. The multi-station audio distribution apparatus of claim 18, comprising more than two listening stations.

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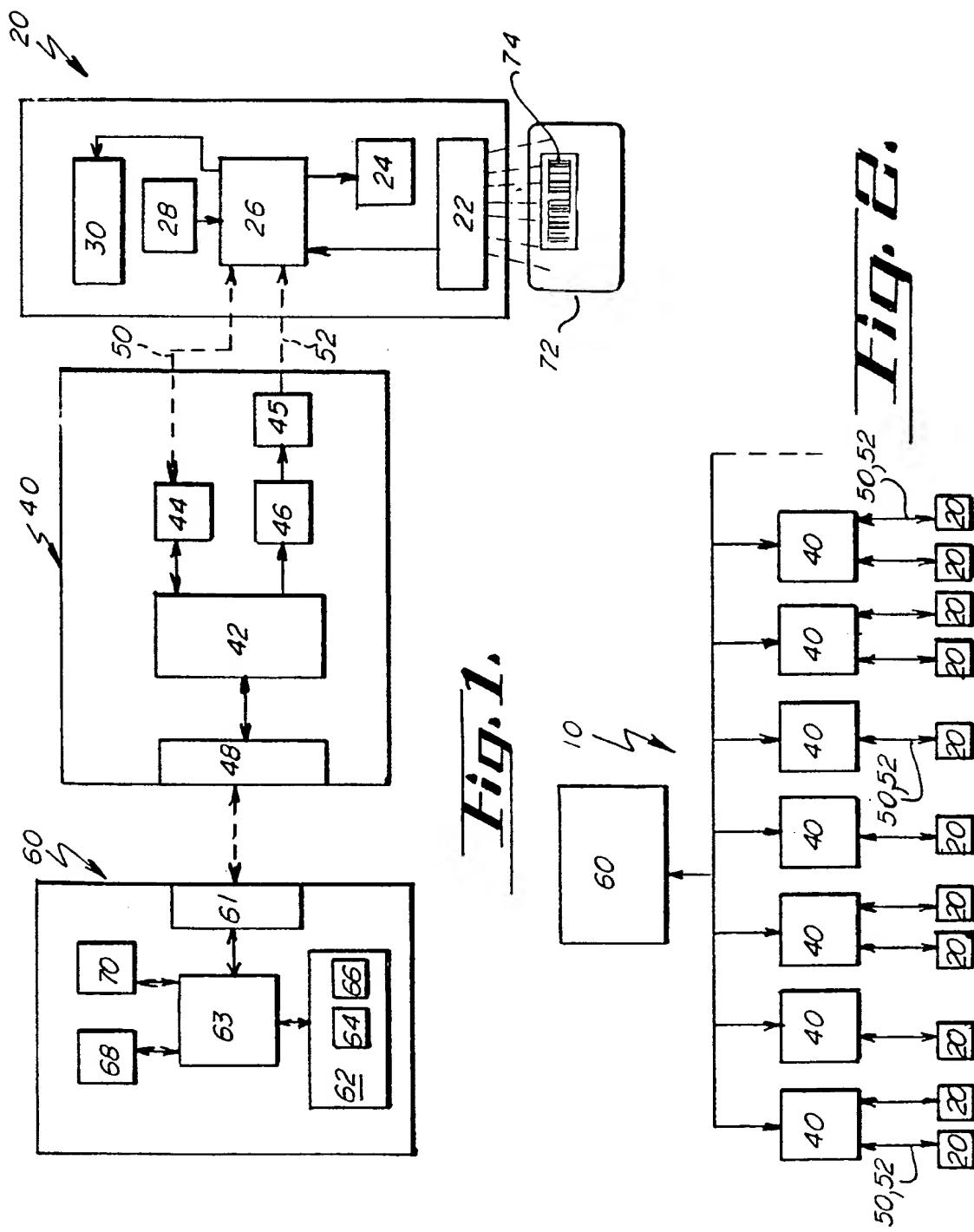
20. The multi-station audio distribution apparatus of claim 18, comprising a plurality of listening station interface means.

21. The multi-station audio distribution apparatus of claim 18, wherein said apparatus adjustments comprise a volume control and a track select.

22. The multi-station audio distribution apparatus of claim 18, wherein said data control means is a computer.

23. The multi-station audio distribution apparatus of claim 18, wherein said audio output comprises a phono jack connectable to headphones.

24. The multi-station audio distribution apparatus of claim 18, wherein said low voltage listening station interface means is connected to said at least two listening stations by low voltage cables.



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(51) International Patent Classification <sup>6</sup> : <b>H04N 1/02, G07F 17/16, G06F 17/60</b>		A3	(11) International Publication Number: <b>WO 98/25364</b> (43) International Publication Date: 11 June 1998 (11.06.98)
(21) International Application Number: <b>PCT/US97/13572</b>		(81) Designated States: JP, European patent (AT, BE, CH, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE).	
(22) International Filing Date: <b>31 July 1997 (31.07.97)</b>		Published <i>With international search report. Before the expiration of the time limit for amending the claims and to be republished in the event of the receipt of amendments.</i>	
(30) Priority Data: <b>08/760,640 4 December 1996 (04.12.96) US</b>		(88) Date of publication of the international search report: <b>27 August 1998 (27.08.98)</b>	
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(74) Agent: HELGET, Gerald, E.; Palmatier, Sjoquist, Helget & Voigt, P.A., Suite 501, 6600 France Avenue South, Minneapolis, MN 55435 (US).			
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<p>A multi-station audio distribution apparatus having at least two listening stations, a data control mechanism and a listening station interface mechanism disposed between the listening stations and the data control mechanism. Each of the listening stations has a user input in the form of a barcode scanner to enter an audio material selection and each has an audio output. The data control mechanism retrieves digitized audio material corresponding to each of the user's audio material selections. The listening station interface mechanism transfers the user's inputs from each of the listening stations to the data control mechanism, receives the digitized audio materials corresponding to each user's input from the data control mechanism, converts the digital audio materials to analog audio signals and transfers the analog audio signals to each of the respective listening stations for the audio output.</p>			

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# INTERNATIONAL SEARCH REPORT

International Application No

PCT/US 97/13572

**A. CLASSIFICATION OF SUBJECT MATTER**

IPC 6	H04H1/02	G07F17/16	G06F17/60
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**B. FIELDS SEARCHED**

Minimum documentation searched (classification system followed by classification symbols)

IPC 6 H04H G06F G07F

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

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**C. DOCUMENTS CONSIDERED TO BE RELEVANT**

Category	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 5 237 157 A (KAPLAN JOSHUA D) 17 August 1993	1, 4, 6
Y	see column 2, line 50 - column 6, line 56; claims 1-11	2, 3, 5, 7, 8, 10-12, 14, 16, 18-20, 22, 24
Y	EP 0 711 073 A (SONY CORP) 8 May 1996  see column 3 - column 6, line 12	2, 3, 7, 10-12
Y	EP 0 505 304 A (IBM) 23 September 1992  see column 4, line 10 - column 6, line 32  ---	5, 8, 14, 16, 21, 23
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# INTERNATIONAL SEARCH REPORT

International Application No  
PCT/US 97/13572

## C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	WO 95 30212 A (MUSIC VENDING INC ;PETERS STEVEN A (US); PERINE MICHAEL (US); BAKE) 9 November 1995 see page 15 - page 17, line 7 ----	18-24
T	EP 0 817 139 A (SUN MICROSYSTEMS INC) 7 January 1998 see column 4, line 47 - column 8, line 34 ----	1-24
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